

Part 1.

I am going to take the bottom left hand point of the bridge as the origin (0,0).
The graphs need to pass through (0,0), (30,12) and (60,0)

I am going to fit a ln function and quadratic function

1. The ln function passes through (0,0) and (30,12). The basic ln function passes through (1,0) so I need to translate the basic function 1 to the right and then make sure it goes through (30,12)

①

$$y = k \ln(x + 1) \quad 12 = k \ln 31 \quad k = 3.494 \quad y = 3.494 \ln(x + 1)$$

As we only want the function from 0 to 30 the domain must be limited to $0 \leq x \leq 30$.

The function goes through the correct points, but goes up too steeply at the beginning and goes on up after the top of the bridge. It has a vertical asymptote when $x = -1$.

②

2. The quadratic passes through (0,0) has a vertex at (30,12) and passes through (60,0)
I have put these three points into my graphics calculator and fitted a quadratic model

$$y = -0.01333x^2 + 0.8x$$

The whole function has these features:

It passes through (0,0), (30,12) and (60,0), it has a vertex at (30,12), it is a sad quadratic, and it has $x=30$ as an axis of symmetry.

③

This also needs a domain of $0 \leq x \leq 30$ for the first part of the bridge.

Here are my graphs, plotted only for the first part of the bridge.

